

Small-scale Forestry Development in Leyte, Philippines: The Central Role of Nurseries

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This paper presents results of survey research into the role of the forestry nursery sector in the development of smallholder forestry in Leyte, Philippines. Seedling production in the province is basically carried out by three categories of nurseries: individual, communal and the government. Seedlings in the government nurseries are primarily raised for free distribution to landholders but the extension scheme fails to reach the majority of the smallholder farmers. Seedling demand of landholders is mostly catered for by the more numerous and accessible individual and communal nurseries. However, problems of capital outlay, sources and supply of germplasm, technical knowledge in nursery management for both timber and fruit trees and low sales are among the major impediments in the sustainability of small-scale nurseries. Most of the communal nurseries fail to sustain the operation after the withdrawal of supporting agencies. Knowledge on site-species matching is needed not only by small-scale nursery operators but also by the managers of government nurseries. It is concluded that the seedling industry in the province is not well established and there is a need to organise better the overall nursery system so as to improve the availability of seedlings and promote appropriate site and species combinations.

Keywords: smallholder forestry, forest nursery, germplasm, seedling prices

INTRODUCTION

For the past decade, there has been an emerging interest in small-scale forestry in the Philippines. Government programs and policies on forest management have shifted from the traditional large-scale industrial forestry which was oriented towards timber products, to multiple product-based and people-oriented small-scale tree farming systems (Mangaoang 2002). However, despite the considerable support of the government and the apparent availability of tree establishment technologies, the extent of small-scale tree farming in the country is still at a low level.

Lack of availability and low quality of planting stock appear to be the major impediments to both planting and selection of species by small-scale farmers in the Philippines (Herbohn *et al.* 2001). Currently, the species planted are strongly influenced by the available germplasm¹ of a few common species with insufficient consideration given to site-species matching. Further, seedlings used in most smallholder tree plantings are usually of low quality. These conditions have resulted in high mortality and poor growth of planted trees.

Seedling production is an integral part in most tree growing programs, an activity which is largely done in most government nurseries. However, many people's organisations and individual farmers in the province of Leyte are also producing planting stock for their own use or for sale to interested parties. Investigation of the constraints, opportunities and organisation of these nurseries is deemed necessary in order to formulate possible intervention schemes that will facilitate the production and extension of high quality planting stock to the landholder level. This will also require consideration of species selection and quantity required by the landholders. Further, given that nurseries are often visited by landholders prior to any tree planting activity, assessment on the potential role they can play in extending site-species matching information to the landholders is likewise necessary.

In this paper, the constraints and opportunities of the three major nursery types in Leyte are discussed. The research need is highlighted and the method adopted in gathering the information and analyses undertaken to come up with a better view of the data is presented. Survey findings are presented about the nursery types identified and issues including opportunities, constraints hampering the operation of the nurseries, species selection process and seedling distribution schemes are discussed. Some key problems are identified, and suggestions are made about possible intervention measures to improve the nursery industry and facilitate the development of small-scale forestry in the province.

RESEARCH METHOD

Site Selection

The study was conducted in the province of Leyte on Leyte Island in the Eastern Visayas region in the Philippines. Leyte Island has an area of 750,000 ha, population of 1.53 M as of the 1992 census and a literacy rate of 94%. The island is divided into two provinces, Leyte and Southern Leyte. Leyte province has a total land area 571,208 ha with 35% remaining under forest cover. The people mainly speak two dialects, namely Cebuano on the western portion and Waray on the eastern side. The province has two major cities – Tacloban (the capital) and Ormoc – and is composed of 41 municipalities with 1,641 barangays or villages (Groetschel *et al.* 2001). Agriculture contributes 49.8% of the gross national product of the province (DOST and ASTI 2003). The main source of income for the majority of the population comes from production of crops, livestock and marine products. In 1997, the average

¹ Germplasm refers to seed or any vegetative material used for the purpose of plant propagation (Mulawarman *et al.* 2003).

annual household income was PhP67,291² and the poverty incidence was approximately 40.8% (Groetschel *et al.* 2001).

The nursery survey was initially focused within four municipalities in Leyte province, namely Isabel, Babatngon, Matalom, and Inopacan which are sites of the Australian Centre for International Agricultural Research (ACIAR) *Small-holder Forestry Project*. The limited number of nursery operators in the proposed study sites, however, resulted in extension of the survey to include another 20 municipalities within the province.

Selection of Respondents

Survey respondents included the small-scale forest nursery operators (individual and communal) and relevant staff of government-managed nurseries. The lack of any list of forest nursery operators from concerned agencies including the Department of Environment and Natural Resources (DENR), Department of Agriculture (DA) and Local Government Units (LGUs) prompted the selection of respondents from several municipalities using the snowball selection approach. Identification of respondents started from the municipalities in which there were continuing small-scale tree planting activities. This was done on the basis that nurseries were likely to be found in the area or that people involved in the activity would know others who were producing planting stock. Information about the presence of nursery operators within the municipality was gathered from key informants including personnel from DENR, DA and LGUs and from local residents. Information about the existence of nurseries established by the government was also collected and interviews of relevant staff were undertaken. All of the nursery operators identified in each site were interviewed.

Data Gathering

Personal interviews were carried out using a semi-structured questionnaire, which was tested on a small number of nursery operators with similar conditions to the target respondents. Further, important secondary data about the nursery groups and information pertaining to the programs of the government to support small-scale forestry were taken from files and records.

Focus group discussions were conducted with all respondents after the nursery visits and interviews. These were done not only to validate and confirm the information that was gathered but also to provide an avenue for nursery operators or managers and personnel from concerned agencies to share their experiences, discuss their problems and formulate possible solutions. Four sessions each lasting for three to four hours were held at Inopacan, Villaba, Ormoc and Tacloban. These venues were chosen to facilitate access of the respondents to the discussion. Each session was attended primarily by nursery operators from municipalities adjacent to each discussion site with the presence also of some personnel from the DENR, DA and LGU. Issues discussed included opportunities and constraints of the operation of the three nursery groups, species availability and selection process, sources and channels for obtaining germplasm, extension schemes, assistance given by supporting agencies and possible alternative measures to improve the overall forest nursery industry in the province.

² \$US1.00 = approximately 50 Philippine pesos (PhP).

The data were organised using the SPSS statistical program. Descriptive statistics – frequencies, percentages, means and cross tabulations among variables – allowed a comparison of the characteristics and performance of three nursery types identified in the survey.

RESULTS AND DISCUSSION

Nursery Types

The number of respondents from each nursery group is reported in Table 1. A total of 74 nursery operators in 24 municipalities were identified and interviewed. There were more individually operated nurseries compared with those managed by community organisations or people's organisations (POs). Government nurseries are those that were established by the government agencies including the Department of Environment and Natural Resources (DENR), Department of Agriculture (DA), Philippine National Oil Company (PNOC) and Leyte State University (LSU)

Table 1. Types and counts of nursery groups included in the survey

Nursery type	Frequency
Individual	37
Communal	22
Government	15
Total	74

Individual (or family) nurseries

Individual farmers, with the help of their family members, raise planting stock mainly for their own farm, and also for sale to other farmers or sometimes to the government. Most of these nurseries were established in response to the difficulty in obtaining planting stock from government nurseries, which are usually far from villages and hence less accessible to most smallholders. The nursery structure is basically temporary in nature, usually made of tree branches or bamboo poles with coconut leaves as shade material. This is generally established next to the house of the operator for ease of maintenance and security against pilfering and stray animals.

Communal including People's Organisation nurseries

These nurseries are established by a group of people in the community for the purpose of raising planting stock for communal planting, sale or distribution to the members of the organisation. Usually, this is project-initiated and the people are organised by a supporting agency to act as partners in implementing a particular forestry project. This may be a Community-Based Forest Management Project (CBFMP), Community-Based Resource Management Project (CBRMP), Reforestation Project or other development project designed for sustainable management of the natural resources and to improve the socio-economic status of the local people. In this type of nursery, the seedling production schedule, quantity of planting stock and species raised are decided jointly by the organisation and supporting agency. In most cases, the participating members are paid for raising the

seedlings and a formal protocol exists for sharing of future benefits from community use and sale of timber. The nursery is often located centrally within the community for easy access of all members. In some cases, this is situated close to the communal planting site (which may be far from the barangay) for ease in transporting seedlings during field planting. The nursery structure is semi-permanent to permanent in nature. Aside from housing planting stock, the nursery also functions as a venue for meetings with extension agents, training activities and social gatherings of organisation members.

Government nurseries

Government-owned nurseries are usually situated in a major city or town. Seedlings are produced mainly for the purpose of free distribution to all interested parties. Experienced workers who are paid either on a contract or regular basis usually carry out the seedling production activities and the volume of seedlings produced is normally higher than that of the individual and communal nurseries. With a well-established structure, this type of nursery is usually permanent in nature.

Objectives of Production

The primary purpose of seedling production varies among the three nursery groups (Table 2). Individual nurseries were primarily established to raise seedlings for personal plantings and for sale. On the other hand, only a small proportion of communal nurseries are selling seedlings, the majority are producing planting stock only for communal planting or distribution to organisation members. Almost all of the planting stock raised by the government are for free distribution to landholders.

Table 2. Primary purpose of planting stock production

Purpose	Proportion of the nursery group (%)		
	Individual	Communal	Government
Internal/personal use	48.6	72.7	6.7
For sale	48.6	18.2	6.7
For free distribution	2.8	9.1	86.6

Sources of Nursery Inputs

In individual nurseries, all inputs – including financial, material and technical inputs – are supplied by the operator. The members of the family usually supply the labour requirements in the nursery. A few operators, however, have acquired seeds, wildlings³ and polythene potting bags from the government. On the other hand, because most of the communal nurseries are project-initiated, they have access to some funds for nursery activities, materials and infrastructure. The labour is usually from within the members of the organisation, and in most cases it is paid from the project fund or else from the sale of seedlings. Further, technical advice is readily available from the supporting agencies. Being part of the program of the agency,

³ Wildlings are seedlings that grow naturally and usually found under trees that have fruits and seeds (ERDB 1998).

government nurseries have a permanent annual budget with full-time experienced personnel that manage the overall nursery activities.

Species Selection and Species Raised

Selection of species is initially based on the objectives of production. For example, those nurseries that are selling seedlings placed attention on demand for the species while those who raised seedlings for their own plantings looked into the growth and timber quality of the species. In project-based communal nurseries, recommendations of supporting agencies is also a major consideration. Nevertheless, the supply of germplasm and difficulty in producing the planting stock are still the major deciding factors in choosing the species to raise. The species that are commonly grown in all nursery types are reported in Table 4. Of all the species raised, mahogany ranks as the most common followed by gmelina and mangium. These species have been planted in previously government-initiated reforestation projects and germplasm is now available from the planted trees. The increased interest in bagras by nursery operators and tree growers is attributed to increasing demand for seedlings and timber, respectively. This species is not only used as a pulp and plywood material; the straight form of its bole makes it as a good substitute for dipterocarps in making electricity poles. Narra, molave and lauan are also widely raised because of their premium wood quality.

Table 4. Most commonly raised species in each nursery type⁴

Species ^a	Fraction of nurseries growing species by nursery type (%)		
	Individual	Communal	Government
Mahogany (<i>Swietenia macrophylla</i>)	67.6	72.3	100.0
Gmelina (<i>Gmelina arborea</i>)	78.4	31.8	86.7
Mangium (<i>Acacia mangium</i>)	37.8	50.0	46.7
Narra (<i>Pterocarpus indicus</i>)	24.3	45.6	73.3
White lauan (<i>Shorea contorta</i>)	8.1	40.9	20.0
Bagras (<i>Eucalyptus deglupta</i>)	13.5	18.2	20.0
Molave (<i>Vitex parviflora</i>)	10.8	22.7	13.3

^a The first three species listed here are exotics to the Philippines.

Information on Site-species Matching

Most small-scale nursery operators have no knowledge of site-species matching. About 77.3% of communal nursery managers admitted that they lack information on proper site and species combinations. Conversely, 62.2% of individual nursery operators claimed that they have some information on this aspect, although their knowledge was largely based on observations of planted and naturally growing trees. Few of them have attended formal training or received formal advice about this subject.

Contrary to expectations, several managers of government nurseries were also found to be uninformed about site and species combinations. Even managers in

⁴ Scientific names were sourced from Rojo (1999).

DENR nurseries who are mostly foresters admitted their lack of knowledge on this subject. The level of site-species matching knowledge was even lower in other nurseries such as those managed by the DA. Most of the managers in these nurseries are agriculturists; hence their knowledge about forest trees is limited.

Seedling Sales and Demand Situation

The mean selling price of species raised in individual nurseries is generally lower than that of communal nurseries (Table 5).

Table 5. Average selling price of seedlings raised in small-scale nurseries

Species	Selling price (PhP)			
	Individual nursery		Communal nursery	
	Range	Mean price	Range	Mean price
Mahogany	3.00-20.00	6.53	7.00-15.00	14.00
Gmelina	2.00 - 5.00	3.75		5.00
Narra	3.00-10.00	5.83	5.00-20.00	13.00
Lauan	5.00-15.00	10.00	15.00-20.00	17.50
Bagras	2.50-10.00	6.12		15.00
Agoho		2.50		7.00
Mangium	3.00-10.00	5.80		7.00
Molave	5.00-10.00	8.33		20.00
Dao			15.00-20.00	17.50
Bagalunga				15.00
Dalingdingan				15.00
Bagtikan		20.00		20.00
Yakal				20.00
Batete				20.00
Hindang				20.00
Bitanghol				20.00
Kalumpit				20.00
Almaciga				20.00
Kamagong				20.00
Patsaragon				20.00
Auri	2.50 - 5.00	3.50		
Akleng parang		2.50		
Kakawate		2.00		
Toog		5.00		
Kulipapa		5.00		
Marang		15.00		
Ilang-ilang		5.00		
Malakawayan		10.00		

Note: Selling prices with no range values indicate that only one operator is selling such species.

No reliable information on production cost was obtained because most of the operators do not keep records of expenses incurred in raising planting stock. The higher selling prices of seedlings in communal nurseries could be attributed to the

labour cost as a result of organisation members maintaining the seedlings being paid on a daily basis. In contrast, labour cost is seldom included in deciding the selling price of seedlings in individual nurseries. In government nurseries, seedlings are extended free to landholders, but in some cases seedlings were sold at a token price to instill a sense of value of the planting materials.

About 54% of the individual nurseries are selling seedlings while only 13.6% of the communal nurseries accept seedling orders. This implies that individual nurseries are more commercial in nature; hence their operation is largely determined by demand for the planting stock. No clear data on seedling sales were obtained because the majority of operators do not maintain records of their sales. Nevertheless, it was emphasised that low sales have caused most of the commercial nurseries to cease their operation. Low sales could be attributed to two factors, namely the wrong choice of species and lack of public information about what seedlings they can supply or lack of advertising. Notably, most of the nursery operators, especially in the individual nurseries, are raising seedlings not because the species is in demand but rather due to the direct availability of its germplasm. In fact, there is little if any demand by landholders for some of the species being grown. There is a lack of advertising about the existence of the nurseries and types of species raised. The forestry department has not conducted an inventory of nursery operators; thus the existence of most nurseries and the species that these can offer is unknown to many buyers.

Experience in Forest Nursery Management

About two thirds (64.9%) of the individual nursery operators had no previous hands-on experience in forest nursery-related activities. However, during the course of nursery operation, many of them attended training in nursery management sponsored by either government agencies or non-government organisations. Similarly, most of the managers in the communal nurseries (72.7%) had no prior experience in nursery management but almost all of them (86.4%) have attended forest nursery and related training. Most of this training was provided as part of the community forestry project activities.

There is a significant relationship between the attendance of individual nursery operators of forestry-related training and the membership of the operators in community and people's organisations (p value = 0.033). It appears that operators who are members of farmer organisations had greater opportunities to attend forestry related training compared to non-members. Most organisations are the result of formal community organising processes – which could explain the heightened awareness and interest of operators in attending training related to forestry. Further, assisting agencies normally target community organisations in conducting training activities to cover a wider audience and facilitate attendance. Table 3 shows the list of community organisations in which individual nursery operators participated and the locality where these have existed.

Table 3. Community organisations in which individual nursery operators participated

Name of Organisation	Locality
Cambantad Upland Farmers Association	Cambantad, Villa Magsaysay, Babatngon
Coconut Farmers Association	Conalum, Inopacan
Coconut Planters Cooperative	Lawis, Merida
Conalum Agricultural Farmers Association	Conalum, Inopacan
Cienda San Vicente Farmers Association	Cienda, Baybay
Eastern Visayas Rural Development Foundation	Bagong Silang, Babatngon
Federation of San Miguel Integrated Farmers	San Miguel
Reforestation and Irrigators Association Incorporated	
Kapunungan sa mga Yanong Mag-uuma sa Kakahuyan	Tahod, Inopacan
Lifewatch Foundation-Ecological Guarding	San Vicente, Matag-ob
Matag-ob Community Welfare Association	Matag-ob
Matalom Farmers Upland Development	Matalom
Paraclete Integrated Agroforest Development Authority Incorporated	Kinautdan, Sta. Fe
Rizal II Marketing Cooperative	Rizal II, Babatngon
Sta. Cruz Farmers Association	Sta. Cruz, Villaba
TLC Women's Organisation	Malinao, Mahaplag
Upland Farmers Multipurpose Cooperative	Cambantad, Villa Magsaysay, Babatngon

Technical Skills in Planting Stock Production

In general, the operators possess the basic skills needed to raise the seedlings. Most of the individual operators have learned these skills through trial and error while the majority of the group operators have gained the knowledge from attending formal training sessions. Nevertheless, it is apparent that the experience of the operators is limited and there is still a dearth of knowledge on proper production techniques. It was observed that planting stock produced in the nurseries is not of high quality. Table 6 shows that among the 20 species taken for destructive sampling from all nurseries, only two had desirable sturdiness quotient values, which indicates that most of the seedlings raised were basically lanky or etiolated. Sturdiness quotient (SQ) – the ratio of the height of the seedling to the root collar diameter – expresses the vigour and robustness of the seedling. The optimal value for a seedling to be considered sturdy is less than six (Jaenicke 1999). With regards to root-shoot ratio, Jaenicke (1999) argued that a seedling with balanced root and shoot biomass should have root-shoot ratio between one and two. None of the seedlings sampled from the nurseries attained the desired value. All had values of less than one, which means that shoot biomass is too high compared to root biomass. These findings indicate that the seedlings raised both in small-scale and government nurseries are of sub-optimal quality and unlikely to withstand the adverse conditions in most planting sites.

Table 6. Mean sturdiness quotient (SQ) and root shoot ratio (R:S) of sample seedlings

Species	Individual		Communal		Government	
	SQ	R:S	SQ	R:S	SQ	R:S
Mangium (<i>Acacia mangium</i>)	13.5	0.19	13.3	0.16	13.8	0.16
Lanete (<i>Wrightia pubescens</i>)	9.4	0.35				
Narra (<i>Pterocarpus indicus</i>)	8.9	0.38	12.2	0.26	12.2	0.38
Mahogany (<i>Swietenia mahogany</i>)	8.2	0.22			9.6	0.22
Gmelina (<i>Gmelina arborea</i>)	7.1	0.35			7.9	0.50
Molave (<i>Vitex parviflora</i>)	10.0	0.33	8.6	0.29		
Makawalo	8.7	0.36				
Malakauayan (<i>Podocarpus rhumpii</i>)	11.4	0.26				
Ilang-Ilang (<i>Cananga odorata</i>)	12.3	0.35				
Red lauan (<i>Shorea negrosensis</i>)			11.8	0.38		
Dao (<i>Dracontomelon dao</i>)			6.5	0.37	6.6	0.43
Bagtikan (<i>Parashorea malaanonan</i>)			5.5	0.47		
Dalingdingan (<i>Hopea foxworthyi</i>)			9.2	0.34		
Bolong-eta (<i>Diospyros philosantha</i>)			5.3	0.29		
Yakal kaliot (<i>Hopea malibato</i>)			8.9	0.24		
Anislag (<i>Securinega flexuosa</i>)					8.6	0.64
Rain tree (<i>Samanea saman</i>)					8.1	0.29
Malapanau (<i>Dipterocarpus kerrii</i>)					7.1	0.84
Kalumpit (<i>Terminalia microcarpa</i>)					8.1	0.46
Balobo (<i>Diplodiscus paniculatus</i>)					8.0	0.67

Root deformation in the form of J-rooting, twisting and curling was commonly observed from sample seedlings. This is alarming considering that it will not only impair the uptake of water and nutrients from the soil but also will make the plant vulnerable to windthrow as it grows older (Carter 1987). The J-rooting probably results from lack of care in the nursery such that the taproot is bent during the potting operation. The risk of developing J-roots increases when wildlings are used especially if taproot pruning is not practiced prior to potting. The lack of taproot pruning (in a situation where most of the nurseries are using wildlings) arises because many operators believe that root pruning would risk the survival of potted seedlings. Rather than cutting the long taproot, the usual practice is to bend, twist and in some cases wind the taproot so its entire length can be accommodated in the container. This could be the principal reason for widely observed occurrence of J-rooting.

Nursery Operation Status

The operational status of the three nursery groups is shown in Table 7. Almost half of the individual nurseries have stopped producing planting stock while about one third of the communal nurseries are likewise inactive. Conversely, almost all of the

government nurseries are still producing seedlings. The low level of sales of seedlings and the unavailability of germplasm have been the cause of the individual nursery operators ceasing operation. On the other hand, exhaustion of funds, declining interest of organisation members and disintegration of people's organisation after the withdrawal of supporting agencies were the reasons for communal nurseries ceasing their operation. It was noted that most of the community groups have decreasing membership, which indicates the instability of their operational status. Having a constant budget, almost all of the government nurseries are still producing planting stock.

Table 7. Operation status of the nurseries included in the survey

Nursery type	Proportion (%) of the nurseries	
	Operating	Not operating
Individual	56.8	43.2
Communal	68.2	31.8
Government	93.3	6.7

The sustainability of nursery operations among individual operators is related to land ownership. Chi-square tests reveal that a significant relationship exists between land availability and nursery operation status (p value of 0.034). Most of those who own land are the ones who are still actively producing planting stock. Land availability serves as buffer against the condition of low sales as unsold seedlings will not be discarded because operators plant these materials on their own land.

The Seedling Distribution Scheme of the Government

The DENR carries out the main seedling production and distribution program of the government. The Department of Agriculture is also producing some seedlings of forest trees. However, the majority of the planting stock that this agency extends to landholders are of agricultural crops rather than trees. Unlike DENR, which has an annual budget appropriation for seedling production, DA has no permanent budget allotted for the production of forestry seedlings, and only produces as a direct response to the demand of landholders and not as a major part of the program of this agency.

The DENR has one regional office, one provincial office and four community offices in Leyte province. All these offices are producing planting stock for distribution to landholders, with the regional office in Tacloban carrying out the bulk of production. On the other hand, the DA has one regional office, one provincial office and municipal offices in each of the 42 municipalities comprising the province. However, only a few of these offices are producing planting stock of forest trees.

The seedlings produced in most government nurseries are for free distribution to landholders. In a few nurseries, however, seedlings are sold at a token price in order to instill value in the planting stock because it was observed that landholders pay more attention to, and value the plants more, if they have purchased the seedlings. Nonetheless, in spite of the availability of free planting stock only a few landholders have acquired seedlings from government nurseries. Emtage (2004) revealed that out of 132 individuals who planted trees in four upland communities under his study,

only 10 individuals obtained seedlings from government nurseries and 94 had raised their own planting materials (Table 8). The implication is that the seedling distribution program of the government has not reached the majority of landholders.

Table 8. Sources of planting stock

Sources of planting stock	Frequency
Own nursery	94
Bought seeds	14
Other nursery	13
DENR	10
Community nursery	1
Total	132

Source: Emtage (2004).

A number of impediments to an efficient seedling distribution program of the government were identified. Among the major constraints are the distance of government nurseries from villages, lack of awareness of the landholders on availability of free seedlings from government nurseries, proof of ownership of the land where the seedlings would be planted and species raised not matching the preference of the landholders.

Distance of government nurseries from the villages

All government nurseries are situated in major towns that are far from most villages making them less accessible for the landholders. Also, the government does not provide vehicles to transport the seedlings from the central nurseries to the villages, making it cumbersome and costly for the smallholder farmers to transport the planting stock. Consequently, only those who live close to the government nurseries and those who have vehicles or can afford to hire vehicles to transport seedlings have benefited much from the seedling distribution program.

Lack of awareness on seedling availability

It was surprising that several individual nursery operators were unaware of the availability of free seedlings from government nurseries. In fact, this lack of awareness was the reason why some of them raise their own seedlings. This shows that a more intensive advertising of the seedling distribution program of the government is needed so that this will be known to a wider population of landholders.

Documentary requirements for requesting seedlings

As part of the seedling distribution process, the DENR requires the landholders to submit a letter of request at the DENR office indicating the species, quantity of planting stock needed and the purpose of planting the seedlings. This should be accompanied with a sketch map of the land where the seedlings are to be planted and a photocopy of the certificate of land title. According to the DENR, these documents are needed for record keeping reasons for future monitoring of the seedlings and to ensure that the seedlings will be planted on titled land, which is a requirement for

tree registration. These requirements act as a barrier to accessing free seedlings. Many smallholders do not hold titles of the land that they are occupying and managing. This alone would already make them reluctant to file the request. In addition, the bureaucracy that exists in the government system is a discouragement to the landholders asking for seedlings from DENR nurseries.

The seedling distribution scheme by DA is simpler in that this agency does not require any documents from the requesting party. Seedlings are readily given as long as the landholder goes to their office and shoulders the expense of transporting the planting stock.

Suitability of the species grown to the demand of the people

Although the selection of species raised in government nurseries is primarily based on the demand of landholders, the constraint on availability of germplasm results in the production of seedlings of just a few common species. Instead of propagating difficult to raise and less available species, government nurseries are producing seedlings of species with germplasm that are readily available, including gmelina, mangium, mahogany and narra. Notably, the landholders also commonly raise these species. This could be one of the main reasons for the low uptake of seedlings by the landholders from the government nurseries.

Seedling production by DENR is mostly contracted to experienced and skilled individuals. In most cases, the contractors have the discretion to choose what species to raise as long as these are amongst the reforestation species identified by the agency. This has resulted in the massive production of common and easy-to-raise exotic species, including gmelina, mahogany and mangium. Recently, however, the regional, provincial and communal offices received a directive from the national office that seedling production should include a considerable proportion of premium native timber species, particularly the dipterocarps. As with DENR, DA also relies heavily on the available germplasm from surrounding trees.

Seedling Recipients and Buyers

Table 9 reports the common buyers from individual and communal nurseries and recipients of seedlings from government nurseries. It shows that the majority of the customers from individual and communal nurseries and recipients of seedlings in government nurseries are private individual landholders and schools. Unfortunately, no data were gathered regarding the population of landholders supplied with seedlings from these three nursery groups, as most of the operators, particularly in individual nurseries, do not keep records on seedling buyers. However, the findings of Emtage (2004) indicate that smallholder nurseries have supplied planting stock to a greater number of landholders as compared to government nurseries. The limited number and lower accessibility of government nurseries has resulted in landholders raising their own seedlings or obtaining planting material from the more numerous and accessible individual and communal nurseries.

Table 9. Common buyers/recipients of planting stock

Buyers/recipients	Number of times mentioned		
	Individual nursery	Communal nursery	Government nursery
Private individuals	21	2	14
Schools/students	11		11
Government agencies	9	2	2
Local government units			6
People's organisations	1	1	1

CONCLUDING COMMENTS

Survey results reveal that there is a need to organise a well-structured nursery system in Leyte province. The nursery industry is poorly established. The government extends planting materials to landholders but the distribution is inefficient. Small-scale nurseries mostly cater for the seedling demand of landholders. Nevertheless, the quality of planting stock produced from these nurseries is generally sub-optimal and the diversity of species raised is limited to a few species with readily available germplasm. Accordingly, there may be a need to support the existence of small-scale nurseries through the provision of technical information and skills development rather than capital and nursery material inputs. Most operators have the basic skills in nursery production but these need to be refined. Refinement does not mean introduction of new practices but rather improving the operator's existing knowledge. Aspects that need to be improved include nursery culture and silvicultural skills, especially for species that are difficult to produce, and the vegetative propagation of preferred fruit trees. Other areas are knowledge of sources and collection of germplasm, selection of mother trees and, most importantly, information on appropriate site and species combinations.

Since low sales volume is a major constraint to the sustainability of most nurseries, establishing a clear market for the planting stock from small-scale nurseries will help sustain their operation. This will help the communal nurseries, which are mostly project-initiated, to shift from the situation of being subsidised to self-sustaining. This is particularly important since experience reveals most community groups disintegrate after the withdrawal of the supporting agencies. Further, provision of security of tenure is an important aspect to consider, promoting the sustainability of the operation particularly for individual nurseries. Lastly, establishment of accessible seed orchards and seed production areas in the province is equally important to help promote the availability of high-quality germplasm.

Given that only a few landholders have benefited from the seedling distribution program of the government because of the remoteness of government nurseries from the villages, the bulk of seedling production should be decentralised to more numerous and geographically dispersed small-scale individual and communal nurseries. Government nurseries can take a more significant role of producing expensive and difficult to raise-species-including Eucalypts and dipterocarps and providing extension works to improve the technical skills of the operators. These

species are highly preferred by the landholders but are seldom raised due to lack of technical expertise and limited germplasm. Decentralising seedling production will not only provide better access of landholders to planting stock but will also enhance the technical skills of the nursery operators and provide a potential source of income. Finally, given the high number and dispersed location of small-scale nurseries, it could serve as potential tool for disseminating information on site-species combination to a greater number of landholders.

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